

## Subclavian Artery Aneurysm Due to Closed Chest Trauma

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THE CASE HERE REPORTED is one of aneurysm in the first portion of the right subclavian artery which was diagnosed six years after the non-penetrating injury to the thoracic cage that apparently caused it.

A 43-year-old Mexican man was admitted to the San Diego County General Hospital on June 14, 1962, for investigation of an intrathoracic lesion first seen on routine survey minifilm in February 1962. A subsequent x-ray film showed a "mass in the right superior mediastinum displacing the trachea to the left."

In an automobile accident in 1956 the patient had received a cerebral concussion, dislocation of the right hip, fracture of the right ankle, and multiple rib fractures of the right lower hemithorax. The latter injury resulted in a flail chest which was treated by external stabilization and tracheostomy. Following discharge from the hospital the patient noted a vague increase in exertional dyspnea after walking a block; this had become more pronounced over the past year. Concomitantly he had slight swelling of the ankles and difficulty in breathing while reclining unless propped on at least two pillows. He has also had occasional vague pain over the right hemithorax unrelated to activity. There was no history of cough, hemoptysis, chills or fever. In the past year and a half the patient had noted infrequent dysphagia, primarily of solid foods.

He was well developed and slightly obese. With the patient recumbent the blood pressure in both

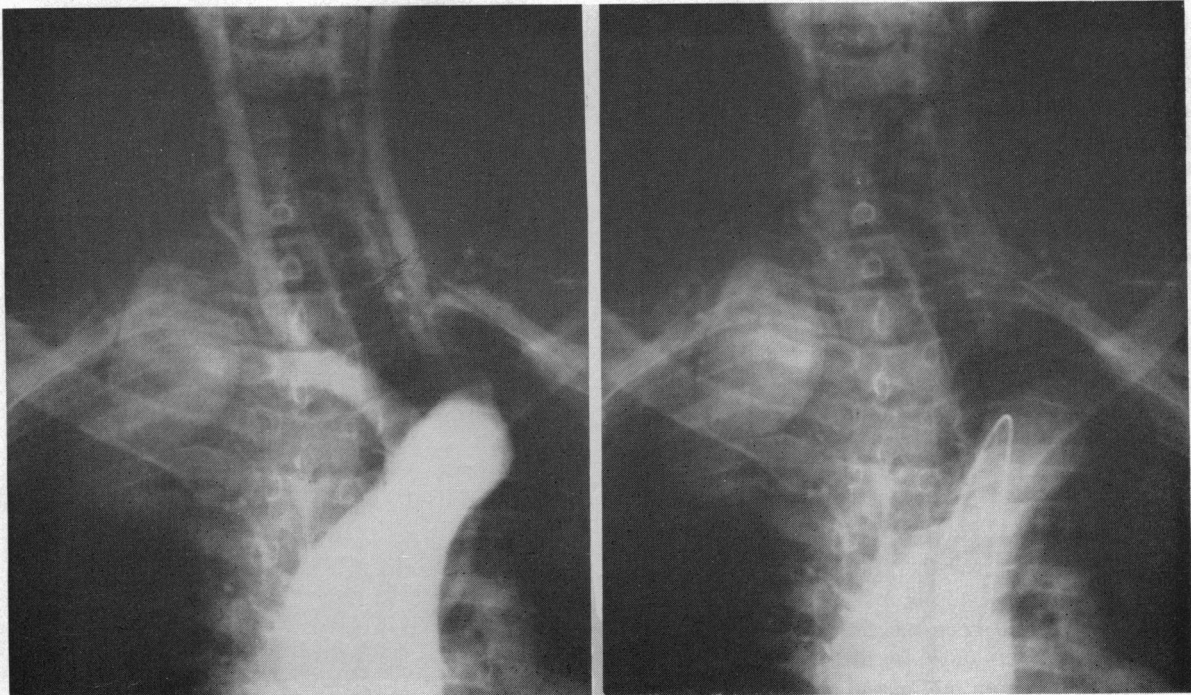


Figure 1.—Retrograde aortogram demonstrating (left) the relation of the aneurysm to the innominate artery bifurcation. Right, later film in the same series showing the disparity of the true lumen and the size of the mass. Note the pronounced displacement of the trachea and mediastinal structures.

arms was 160/110 mm of mercury and the pulse was 80 and regular and equal bilaterally. There was slight ptosis of the right eyelid apparently secondary to his facial injury, and the right pupil was smaller than the left. Both pupils reacted to light. No abnormality was noted on fundoscopic examination. There was no anhydrosis of the face. Veins of the neck were not distended. The thyroid gland was not palpable and the carotid arteries were equal in size. A faint systolic bruit was heard over the right common carotid artery at the base of the neck, and a similar bruit over the right supraclavicular area. The chest was clear to auscultation and percussion. No neurological deficits were noted and the extremities were intact without evidence of atrophy or edema.

Except for evidence of mild diabetes mellitus, results of laboratory examinations were within normal limits. Because of the superior mediastinal mass, an  $I^{131}$  uptake study was done, and the scanogram showed normal configuration of the thyroid gland. Fluoroscopic and radiographic examination of the chest showed a large tumor in the anterior right superior mediastinum with pronounced displacement of the trachea and the esophagus to the left. There was no specific bony erosion or any evidence of pulsation in the tumor. A barium swallow study confirmed the previous findings.

Bronchoscopic examination showed considerable deviation of the trachea to the left with an extrinsic pulsatile area located along the right lateral tracheal wall. The vocal cords were normal, and bronchial washings were negative for malignant cells. A retrograde left common femoral artery arteriogram showed the left common carotid and vertebral arteries to be normal. The innominate artery and the right common carotid artery were well visualized and they also appeared normal. A  $6.5 \times 4.5$  cm aneurysm of the right subclavian artery was seen immediately distal to its take-off from the innominate artery, and the right vertebral artery was faintly visualized (Figure 1). The previously described large, smooth, soft tissue shadow in the upper chest, displacing the trachea, was apparently due to the aneurysm and the laminated thrombus it contained.

At operation a supraclavicular incision was made down the midline, splitting the sternum and along through the third intercostal space. Excellent exposure was obtained (Figure 2).

An aneurysm of the right subclavian artery arose close to the innominate artery bifurcation. It filled almost the entire superior chest, displacing the mediastinum to the left and extending well up into the neck, where it surrounded the brachial plexus. Repair was begun by freeing the innominate, the right carotid, the proximal subclavian and the distal subclavian arteries from the mass and placing clamps

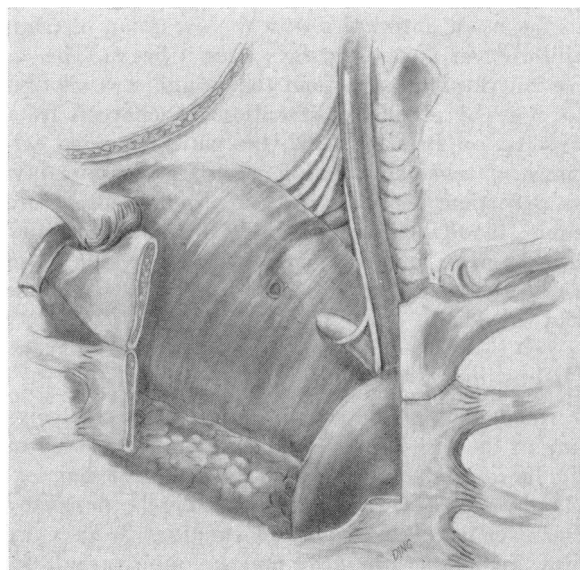


Figure 2.—A semischematic illustration of the surgical exposure in the present case, showing the aneurysm in its relation to the surrounding structures including the vertebral artery, brachial plexus and mediastinum.

on them for control of circulation. The brachial plexus was carefully identified and preserved. To control circulation in the vertebral artery, which appeared to contribute to the arterial supply of the aneurysm, the tumor was opened and the artery was sutured from within. The portion of the aneurysm wall overlying the brachial plexus was left in situ. By proximal and distal anastomosis a preclotted DeBakey graft of 10 mm Dacron® tubing was placed in the subclavian artery. To complete the proximal anastomosis it was necessary to cross-clamp the right common carotid and innominate arteries for a moment. All clamps were then removed and circulation of the upper extremity was restored.

The pathologist's report on the specimen was consistent with either post-traumatic or arteriosclerotic aneurysm. There was no evidence of medionecrosis. In the absence of any other evidence of arteriosclerosis by arteriogram or at the site, and with the excellent clinical history indicating the onset of difficulty coincident with trauma, it appears that the lesion almost certainly was caused by the injury that occurred six years before the operation.

Although erythromycin had been given parenterally immediately before and after operation, major infection of the surgical wound developed on the second day and the patient was febrile. Large amounts of serosanguineous fluid drained from the superior part of the incision. The wound was opened superficially and was copiously irrigated with neomycin sulfate solution. Chloramphenicol, methicillin and penicillin were given by vein.

Cultures of the fluid grew aerobacter aerogenes and escherichia coli, both organisms being sensitive

to the usual antibiotics with the exception of penicillin. Fever abated six days after it began. The infection slowly cleared and the wound was allowed to close by secondary intention. Discharged from hospital on July 20, 1962, the patient had no evidence of residual infection when last examined as an outpatient the following year. Radial pulses were equal, blood pressure was 110/70 mm of mercury in both arms and no abnormalities were seen in an x-ray film of the chest. All the previous symptoms had subsided.

## Discussion

Aneurysms of the subclavian artery may involve any of the three parts of the artery. In a survey of the literature, no predilection for any particular segment was noted. The diagnosis may be suspected from symptoms or from abnormalities in an x-ray film. Symptoms produced may be quite varied, depending on the location and size of the lesion—paresthesias or weakness in one upper extremity, a pulsatile mass at the root of the neck, unilateral clubbing or muscle wasting, or diminished pulses and decreased blood pressure in the affected limb. Hoarseness, Horner's syndrome, and vague pain in the chest are occasional presenting complaints. In some cases the lesion is asymptomatic.

Injury as a causative factor may be relatively minor, or it may be severe; and frequently severe injury is associated with fracture of the overlying clavicle. Most of the cases reported, particularly those attributed to war injuries, were secondary to penetrating wound.

The diagnosis of aneurysm is best established by

arteriography, although such x-ray clues as calcification at the origin of the subclavian artery or linear calcification along the route of the subclavian artery are helpful. Fluoroscopic examination may not demonstrate pulsations, for frequently these aneurysms are surrounded by laminar clot which does not transmit expansile motion. As it not only can delineate the subclavian artery but also show the extent of involvement of the vital cerebral vessels, arteriography is helpful diagnostically and as a guide to surgical approaches. We have found retrograde femoral arteriography, often used for demonstrating the brachiocephalic vessels for other purposes, to be easily adapted to a problem of this type.

The surgical approach depends somewhat on the size of the lesion and the location. The excellent exposure and good proximal control achieved in the present case by sternal splitting certainly recommends this approach for extensive lesions of this region. Excision and reconstructive operation is now the preferred method of treatment.

## Summary

A case report of an aneurysm of the subclavian artery consequent to closed chest trauma is presented. The symptoms were vague and the diagnosis was not made until six years after the injury. Arteriographic delineation was helpful in the diagnosis and in planning operation. Repair was carried out by removal of the aneurysm and the placement of a plastic prosthesis. When wound infection developed, antibiotics were administered locally and systemically, and the infection promptly subsided.

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